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MEGNANICAL-PROPERTY DATA 7007 ALUMINUM

Plate (-T6E136)

Issued by

Air Force Materials Laboratory Research and Technology Division Air Force Systems Command Wright-Patterson Air Force Base, Ohio

November, 1967

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Prepared by

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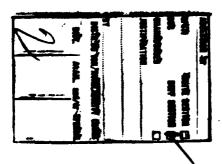
This data sheet was prepared by Battelle Memorial Institute under Contract F33615-67-C-1292. The contract was initiated under Project No. 7381, "Materials Application", Task No. 738106, "Design Information Development". The major objectives of this program are to evaluate newly developed structural materials of potential Air Force weapons-system interest and then to provide data-sheet-type presentations of mechanical data. The program was assigned to the Structural Materials Engineering Division at Battelle under the supervision of Mr. Walter S. Hyler. Project engineer was Mr. Omar Deel. The program was administered under the direction of the Air Force Materials Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, by Mr. Marvin Knight, project engineer.

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7007-T6E136

7007 has been developed over the past 3 years by ALCOA under Contract NAS 8-5452. It shows promise as a tough, readily weldable aluminum alloy and could possibly replace the alloy 2219, which is currently used in space vehicles. Further development work is planned, particularly concerned with the effort to improve the weld properties of this alloy.

The -T6E136 treatment was selected to provide the optimum combination of strength and notch toughness.

The nominal composition of 7007 is as follows: 0.10 Cu, 0.2 Mn, 1.8 Mg, 0.12 Cr, 6.5 Zn, 0.04 Ti, 0.12 Zr, and 0.40 max Si + Fe.

7007 Data(a)

Condition: -T6E136
Thickness: 0.250-Inch Plate

Properties	Temperature, F			
	-320	-105	RT	300
Tension				
Ftu (longitudinal), ksi	98. 1	83.3	72.9	51, 2
Ftu (transverse), ksi	90.2	78.4	69. 1	50.1
Ftv (longitudinal), ksi	83.8	73.2	68.8	49.4
Fty (transverse), ksi	77.5	70.1	65.2	49.5
et (longitudinal), percent in 2 in.	16.0	13.7	14.0	20, 2
et (transverse), percent in 2 in.	13.8	13.2	15.8	20.7
Et (longitudinal), 106 psi	10.8	10.7	10, 1	9.7
Et (transverse), 106 psi	10.8	11.1	10.0	9. 3
Compression				
Fcy (longitudinal), ksi	119.0	119.7	111.2	95.4
F _{CV} (transverse), ksi	119.0	119.0	111.2	103.2
E _c (longitudinal), 10 ⁶ psi	12. 1	11.7	10.8	10.6
E _c (transverse), 106 psi	12.2	11.9	11.0	10,6
Shear(b)				
F _{su} (longitudinal), ksi	Մ(c)	ប	46.2	บ
F _{su} (transverse), ksi	บ	U	44.7	U
Impact (Charpy V-notch), ft-lb	U	3.6	4.2	U
Fracture Toughness, K _{IC} , ksi Vin.	ប	U	No pop-in(d)	ប

Temperature, F				
-320	-105	RT	300	
95	U	73	59	
82	U	53	45	
72	U	39	27	
65	U	52	50	
31	U	20	17	
20	U	16	11	
Temperature, F				
RT		300	500	
NA(c)		18. 2	2.9	
NA.		11.3	1.9	
NA.		27. 5	5.3	
NA		19.6	3.6	
o cracks(f)	U	ប	
	-320 95 82 72 65 31 20 RT NA(c) NA	-320 -105 95	95 U 73 82 U 53 72 U 39 65 U 52 31 U 20 20 U 16 Temperature, F RT 300 NA(c) 18.2 NA 11.3	

12.2 x 10^{-6} in. /in. /F (68-212 F) 13.8 x 10^{-6} in. /in. /F (68-392 F)

Density(g) 0. 101 lb/in. 3

⁽e) Date are average of triplicate tests conducted at Battelle under the subject contract unless atherwise indicated. Fatigue, croop, and stress-rupture values are from date curves generated using the results of a greater number of tests.

⁽b) Single sheer sheet type specimens, full thickness.

⁽c) U = unevallable; NA = not applicable.

⁽d) Fetigue-crocked single-edge-notched specimens (1/4 x 3 x 12 in.) tested in tension. No pep-in detected. Lead-strain aurves were enalyzed by the secont offset method as autlined in ASTM 410 and proved to be invalid tests.

⁽e) "R" represents the algebraic ratio of minimum to maximum stress in one cycle; that is, R = \$min'\$max. "K;" represents the Neuber-Poterson theoretical stress-concentration factor.

⁽f) Three-point bond test. Alternate immersion 3-1/2 percent NaCl. No creeks appeared,

⁽g) Values from Reference (1).

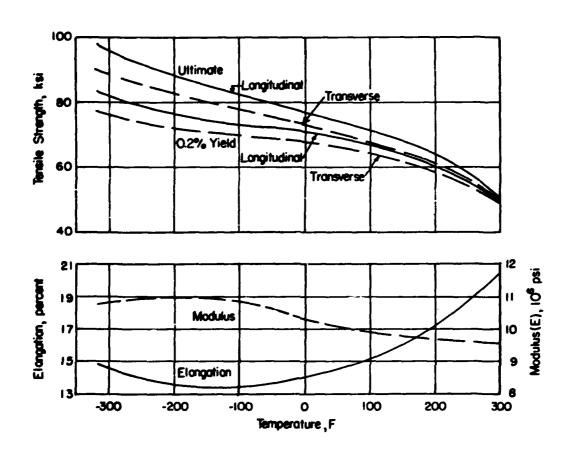


FIGURE 1. EFFECT OF TEMPERATURE ON THE TENSILE PROPERTIES OF 7007-T6E136 ALUMINUM ALLOY PLATE

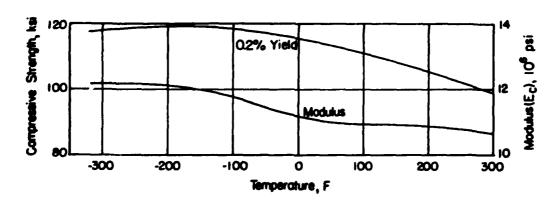


FIGURE 2. EFFECT OF TEMPERATURE ON THE COMPRESSIVE PROPERTIES OF 7007-T6E136 ALUMINUM ALLOY PLATE

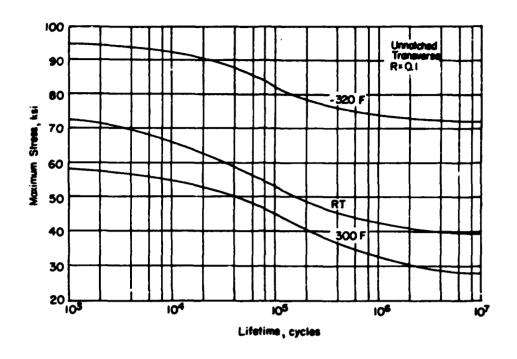


FIGURE 3. AXIAL-LOAD FATIGUE RESULTS FOR UNNOTCHED 7007-T6E136 ALUMINUM PLATE AT THREE TEMPERATURES

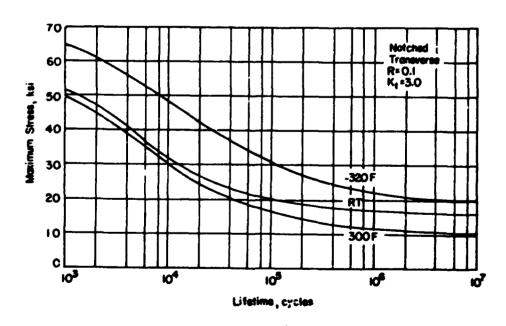


FIGURE 4. AXIAL-LOAD FATIGUE RESULTS FOR NOTCHED (K_t = 3.0) 7007-T6E136 ALUMINUM PLATE AT THREE TEMPERATURES

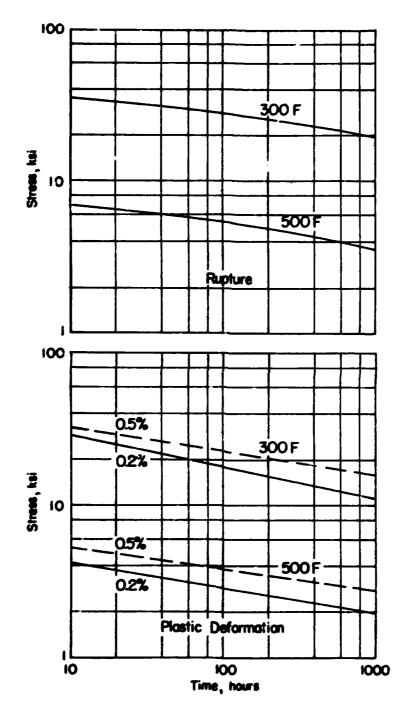


FIGURE 5. STRESS-RUPTURE AND PLASTIC DEFORMATION CURVES FOR 7007-T6E136 ALUMINUM ALLOY PLATE

REFERENCES

- (1) Private communication with ALCOA.
- (2) Westerlund, R. W., and Rogers, R. W., Jr., "Development of a High-Strength Aluminum Alloy, Readily Weldable in Plate Thicknesses, and Suitable for Application at -423 F (-253 C)". Contract NAS 8-5452, Alcoa Research Laboratories (numerous progress reports and annual report dated April 4, 1967).